

## The possible existence of temporal Sub-speciation in *Maniola jurtina* (L.) (Lep., Satyridae)

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It is generally held that the formation of races is dependent upon the isolation of populations from each other, thus creating a protected gene pool, each acquiring particular features suited to its own environmental conditions. The geographical isolate, however, may be linked to other races of the species by a cline in which the two extremes have acquired recognisably distinct characteristics, the intervening populations consisting of either a gradual change from one form to the other, isolated populations consisting of one or other of the extremes (indicating distinct sub-speciation) or, more commonly, a mixture of the two. The factors causing such isolation have been observed to be geographical, in butterflies at least, and it is not surprising that this has been the most frequently observed. It is a comparatively simple matter to find out whether or not two or more populations are isolated from each other; nor does it take a zoologist to tell if the 'extremities' of the range of a widespread species differ in any marked way. Much more difficult to detect, however, are cases of sympatric evolution—where two populations in breeding condition within the 'cruising range' of each other largely keep characters peculiar to itself. The problems of detecting this phenomenon, which is known in plants, are so great that it was 1957 before it was detected in the Meadow Brown Butterfly (see Ford, 1964). Clearly sympatric evolution could well be awaiting discovery in many species of Lepidoptera and other insects, but it is likely, I surmise, that it is very uncommon, if not rare, in zoology.

Temporal sub-species have been the domain of the palaeontologist, but recently I have found a case which suggests that isolation of this nature exists in *Maniola jurtina*. In a previous paper (Thomson, 1969) mention has already been made of voltinism in this Satyrid, a subject to which Verity (1953) and others have contributed. The facts, as we have them, are that *jurtina* has in some parts of its range an exceptionally long emergence and flight period—possibly seven months in some parts of the Mediterranean region. In spite of this the butterfly is univoltine and no case is known where breeding under various conditions has produced a second brood. This is probably partly explained by the fact that the larvae feed at very different rates. What is not so well known is that in many regions, mainly in the south of Europe (but, as we shall see, not exclusively so), the butterfly emerges in late spring or early summer, almost disappears for a few weeks at the height of the summer and then reappears. This second emergence is not simply the earlier specimens appearing again, but a quite fresh emergence of individuals of both sexes.

I collected material evidence of this during my two visits to France—one in 1968 and the other in 1970—and through the help of several friends who went out of their way to collect for me a series of *jurtina* in the south of that country and Spain. In the last week of June 1968 I collected in several parts of Vaucluse, Var, Alps Maritimes and the Basses Alps. Without exception, in these departments I had no trouble in finding a locality in which *jurtina* was common and I collected a series from several localities. In all cases, with the exception of the Esterol, both the males and the females were fresh, showing little sign of wear and tear. I collected such a series at Fountain de Vaucluse, St Valier and Digne. This year, but this time in the third week of July, I looked for the Butterfly at Fountain and found none, at St Valier with great difficulty I was able to get twelve and at Digne two days' hunting produced only four individuals. Although I had no previous experience to compare other localities with those of two years before, the difference between the number of *jurtina* in the two years in south-east France could be described as nothing less than considerable. In spite of this I received a number of fresh *jurtina* from Provence taken in August 1970. Clearly the butterfly had re-appeared after we had left.

Remarkable these facts may be in a species which has been shown, by other criteria, to be univoltine. The presence of a 'double emergence' in British *jurtina* would be surprising in the extreme—but this is, in fact, what has been found by Mr T. D. Fearnehaugh. In 1966 he wrote to me to say, ' . . . Last year an unusual event occurred in that there was a definite second brood. . . . last year (1965) the butterfly was about from late June to mid-September as usual, then on October 16th I was surprised to find a freshly emerged brood in good numbers. . . .'

Through Mr Fearnehaugh I have been able to gather together the following information concerning a population of *jurtina* on the Isle of Wight. For reasons which should be obvious, I would prefer not to disclose the actual location of this insect's haunt.

There exists on the Isle of Wight a population of *jurtina* which every year emerges towards the end of June or beginning of July (a little later than other localities on the island) with a flight period lasting until the beginning or middle of October depending upon the season. During this period there may or may not be a reduction in numbers at the end of August or the beginning of September about which time fresh males and females emerge in varying numbers. From what I can gather, the locality is, to all intents and purposes, similar to other localities on the island, yet in these the species emerges in the middle of June and is well over by early September by which time any stragglers are well worn. The situation throughout the United Kingdom is the same, although the insect comes out a little later in the

north, and I know of very few instances when *jurtina* was still flying in September. In the Isles of Scilly I have collected *cassiteridum* Graves fairly fresh in the second week of September. It is possible that the emergence period is extended there as they are still flying in good numbers when the butterfly has disappeared from the Cornish mainland. The long and double flight period of this Isle of Wight population is therefore similar to that known in the south of Europe, in Sicily, Malta and possibly elsewhere.

Had it been that the actual flight times were the only way in which these late individuals differed from the situation throughout most of its range, I would probably not have investigated the situation much further, accepting the fact that under certain conditions, probably environmentally controlled, some *jurtina* undergo a period of aestivation in the late larval or pupal stage emerging fresh in late summer. However, Mr Fearnhaugh very kindly sent me a series of seventeen specimens taken on the 18th September 1970 (six males and eleven females) all but two in very fresh condition, and two females taken on the 9th October of the previous year, once again fairly fresh. It was immediately apparent that they differed markedly from the long series I have from the island taken in June, July and August over a period of two years. They were consistently smaller than the Isle of Wight series, the males being only 44.2 mm and the females a mere 48.8 mm. This compares with the Isle of Wight averages of 49.9 mm and 55.3 mm—a difference in each sex of about 5 mm. The markings, too, were considerably modified. In both sexes the fulvous was more extensive, much more in the male with several specimens having it spread towards the central area in a fashion typical of the Irish *iernes* Graves. The fulvous of the female while being more extensive was distinctive, the width of the band being narrower, as in *cassiteridum*, and with a clear fulvous 'point' on the hindwings. Also in both sexes, the underside was considerably darker than most *insularis* Thomson and more striate, often approaching a greenish-grey, or greyish-brown but none with the clear yellow light band so frequent on the island in the female. Probably the most remarkable feature of the butterflies was the very small apical eyespot in the female which, furthermore, had the outer margins of the forewings rather more concave.

I then compared early (May and June) and late (August and September) *jurtina* from southern Europe to see if any parallel could be found to what exists on the Isle of Wight. By now, I was not surprised to find that these late *jurtina* also were, in general, smaller with the underside markings darker and more striate, they had the apical eyespot smaller and the fulvous, though more extensive, narrower. I should point out, however, that the occurrence of fresh *jurtina* in late August and September, even in the south of Europe, is not

common but I have evidence of it in the Basses Alps, Vaucuse, Tarn and one or two spots in the north of Spain, although this is complicated by the fact that there is a very fluid situation in which there is no clear-cut line between a rather long emergence period and the cases in which an actual double emergence has taken place.

How then can we explain the fact that, although breeding experiments have been unable to show *jurtina* to be bivoltine (and have almost proved it not to be), field observations and the presence of the different phenotypes in some *jurtina* populations give all the indications that this is, at least very occasionally, the case? I can find no evidence to support the suggestion that there exists sibling species with slightly different emergence times. The genitalia of the two forms are identical. I can offer only one explanation—that in these double-emergence *jurtina* we are seeing the very early stages in the formation of a temporal sub-species, not the temporal sub-species of the palaeontologist, but one in which a certain degree of reproductive isolation has been created by a prolongation of the flight period to such an extent that these individuals which emerge early are effectively isolated from these that emerge much later. It would be difficult, I must admit, to prove such a hypothesis, but in the European butterflies alone there are cases where this could well have already occurred. *Euphydryas aurinea debilis* Oberthur, for instance, emerges when the other *aurinea* races are over, or almost so. Furthermore, in several genera in which most of the species emerge at approximately the same time, there is an odd species which flies much earlier or later than the others. The Satyrid, *Erebia serotina* Descimon and de Lesse is found in September when most of the other species of the genus are over. Perhaps it has become isolated in time from another (possibly extinct) closely related species. Nor is it surprising that we find such examples in genera of single brooded species as this type of evolution might well be their alternative to bivoltinism.

The fact that entomologists have not recognised the differences between the early and late *jurtina* has, no doubt, hindered the acquisition of knowledge of the pattern of races in southern Europe, not by confusing similar races, but by obscuring real differences between them. It would be extremely interesting to determine how widespread is the occurrence of late *jurtina* emergences in central and northern Europe, including the British Isles, to try to establish some pattern which would possibly give us further information about the nature of this interesting phenomenon.

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